Low-cost Arduino-Based Ultrasonic Radar System

Mohammed Alyas, Shreyash Sharma, Mohammed Errarheb, Youssef Reda, Youssef Agiez, Xingguo Xiong
Department of Electrical and Computer Engineering, University of Bridgeport, Bridgeport, CT 06604

Abstract

RADAR uses radio waves to detect the range, altitude, direction, or speed of objects. Radars have been used for airport air-traffic control, highway patrol, ballistic missile guidance, military exercise and many other applications. In this poster, we developed a low-cost tiny ultrasonic radar system based on Arduino. It utilizes ultrasonic sensors to detect the object in the range and passes the information to Arduino microcontroller. Once the object is detected, two sets of alarm can be triggered. The graphical display utilizes the position of the detected objects on the computer to send visual alarm on LED screen. Sound alarm can also be sent via an audio buzzer. By adjusting the rotation of the servo motor, we allow the sensing to be in range from 0 degree to 150 degrees. It can detect objects up to 400 cm away from the ultrasonic sensor. The prototype of the system is implemented and coding for Arduino control is developed. Experimental results show that the system can detect objects within the range and alarm can be successfully triggered.

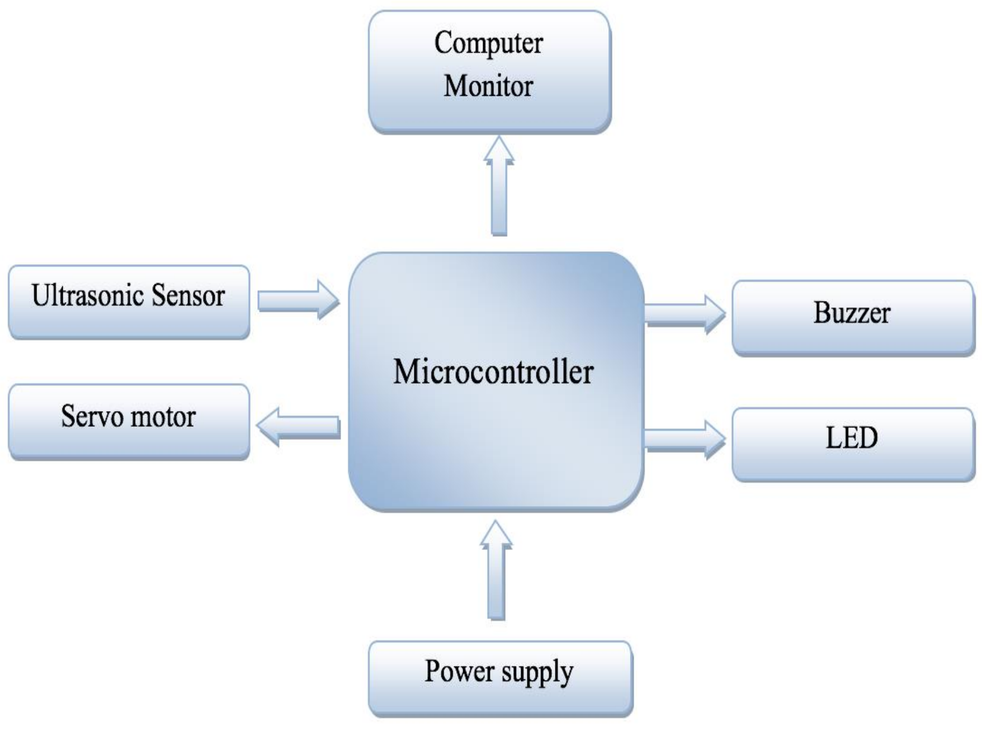
Introduction

ULTRASONIC RADAR is an object-detection system which uses radio waves to determine the range, altitude, direction, or speed of objects. Ultrasonic Radar systems are used for air-traffic control at airports, and long range surveillance and early-warning systems. A radar system is the heart of a missile guidance system. Radar was secretly developed by several nations before and during World War II.The term RADAR itself, not the actual development, was coined in 1940 by the United States Navy as an acronym for Radio Detection and Ranging. The term radar has since entered English and other languages; as a common noun radar loses all capitalization. The use of such technology has been seen recently in the self-parking car systems launched by Audi, Ford, and even the upcoming driverless cars by Google, Tesla,Volvo and BMW. The project made by us can be used in any systems the customer may want to use like in a car, a bicycle or anything else. The use of Arduino in the project provides even more flexibility of usage of the aforementioned module according to the requirements.

Design Consideration

ULTRASONIC RADAR has been receiving increasing attention in recent years from researchers, practitioners, and funding agencies. The idea of making an Ultrasonic RADAR came as a part of a study carried out on the working and mechanism of “Automobiles of Future”. Also, being an engineering students, we have always been curious about the latest ongoing technology in the world like Arduino, Raspberry Pi, Beaglebone boards. Hence, this time we were able to get a hold of one of the Arduino boards, we thought of making it big and a day to day application specific module that can be used and configured easily at any place and by anyone. Moreover, in this fast moving world there is an immense need for the tools that can be used for the betterment of the mankind rather than devastating their lives. Hence, we decided to make some of the changes and taking the advantage of the processing capabilities of Arduino, we decided to make up the module more application specific. Hence, from the idea of the self driving cars came the idea of self-parking cars. The main problem of the people in most of the countries is safety while driving. So, we came up with a solution to that by making use of this project to continuously scan the area for traffic, population, as well as offer protection of the vehicles at the same time to prevent accidents or minor scratches to the vehicle.

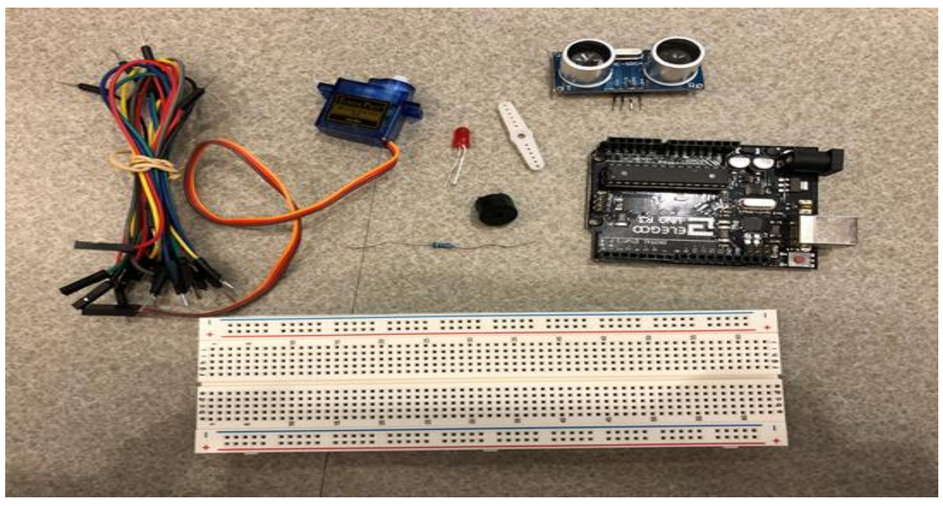
Block Diagram



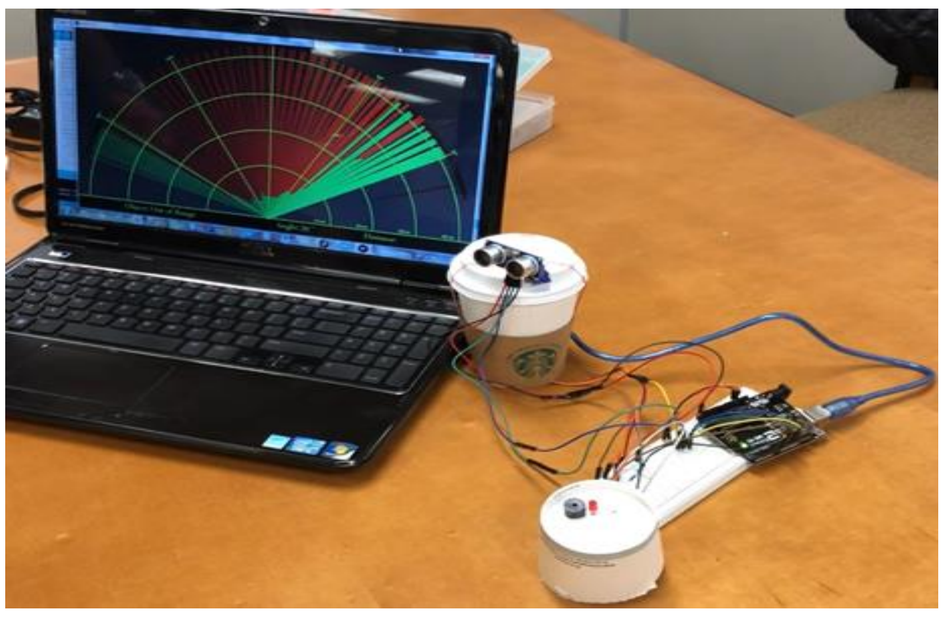
Ultrasonic Sensor

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring wind speed and direction (anemometer), tank or channel level, and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure tank or channel level, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.

Device Fabrication



1. Arduino microcontroller Uno
2. Servo motor
3. Ultrasonic sensor
4. Jumper wire
5. LED.
6. Buzzer
7. USB Cable
8. Resistor (5.1m Ohm)
9. Arduino ide
10. Processing 2.1 ide



Conclusions and Future Work

In this project using Arduino board the radar system was implemented. It succeed in helping to be widely used to help detect objects in different environments. In the future it can be updated to used for a larger range and advancements.

References

[1] Arduino Radar Project.

https://howtomechatronics.com/projects/arduino-radar-project/